

**NASA SBIR/STTR Technologies**  
**Acoustic Resonance Reaction Control Thruster (ARCTIC)**  
**Orbital Technologies Corporation – Madison, WI**

**PI: Scott M. Munson**

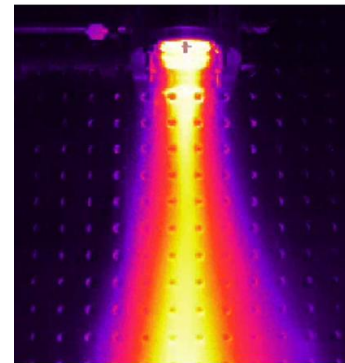
**Contract No. NNX13CC36P**

***SBIR***  
***STTR***

**Identification and Significance of Innovation**

ORBITEC is developing and testing the Acoustic Resonance Reaction Control Thruster (ARCTIC) to autogenously ignite low-pressure hydrogen and oxygen. The ARCTIC thruster uses an innovative method to produce ancillary impulse with indigenous propellants without the use of high-voltage spark systems, toxic hypergols, or catalyst beds. ARCTIC offers significant vehicle-level advantages over current RCS thrusters, resulting in reduced propulsion system mass, complexity, power, and life-cycle cost.

**TRL at end of Phase 1 Contract: 4**



**IR Camera Image of  
ARCTIC-1 Hot-Fire Testing**



**Conceptual Design of Flight-  
Weight Thruster, ARCTIC-2**

**Technical Objectives and Work Plan**

The overall objective of the Phase 1 effort was to develop and test the ARCTIC-1 TCA at sea-level & simulated altitude conditions.

Task 1. ARCTIC System Requirement Definition

Task 2. Design / Fabrication of Boilerplate ARCTIC-1 TCA

Task 3. Cold-Flow Testing with Boilerplate ARCTIC-1 TCA

Task 4. Sea-Level Hot-Fire Testing with ARCTIC-1 TCA

Task 5. Vacuum Ignition Testing with ARCTIC-1 TCA

Task 6. Design of Flight-Weight ARCTIC-2 TCA

Task 7. Project Management and Reporting

**NASA and Non-NASA Applications**

ARCTIC has been designed to scavenge residual low-pressure propellants from a spent upper stage to provide supplemental impulse following sustainer engine cut-off (SECO) in a launch vehicle upper stage such as a Centaur or Delta stage. The ARCTIC thruster is designed to reduce the complexity of ancillary in-space propulsion systems required to perform missions such as propellant settling, orbit circularization, attitude control, and deorbit burns. Additionally, because ARCTIC uses low-pressure propellants, this technology pairs very well with SOTA electrolysis systems to generate gaseous propellants on-demand from liquid water on-orbit.

**Firm Contacts**

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**NON-PROPRIETARY DATA**